Aircraft-Launched High-Resolution Pressure Pod

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LONG-TERM GOALS

The long-term goal of this program is to understand the physics of small-scale oceanic processes including internal waves, hydraulics, turbulence and microstructure that act to perturb and control the circulation in coastal oceans and, in doing so, affect the propagation of sound and light. Ongoing studies within the **Ocean Mixing Group** at OSU emphasize observations, interaction with turbulence modelers and an aggressive program of sensor / instrumentation development and integration.

OBJECTIVES

The objective of this proposal is to construct a rugged, high-resolution pressure pod that can be launched from an aircraft. This will sink to the seafloor for periods up to 3 months. An acoustic release will permit recovery and surface reporting of all data.

APPROACH

We have modified existing electronics hardware to count Paroscientific pressure and temperature frequencies and to integrate GPS receiver and Iridium and wireless transceivers. We are in the process of adapting a release acoustic transducer into the end cap of the Ppod. This will undergo extensive testing at the lab in October/November 2009 and in Puget Sound in December 2009.

WORK COMPLETED

An inertial motion package has been installed. The purpose is to measure directly the impacts on the body when the parachute opens and when the body hits the water. Preliminary tests were conducted by dropping a mockup off the Yaquina Bay bridge (46 m bridge height). Tests from aircraft were conducted in September 2009. Seafloor deployment tests in Puget Sound were conducted in March 2009 and will be repeated in December 2009 and March 2010.

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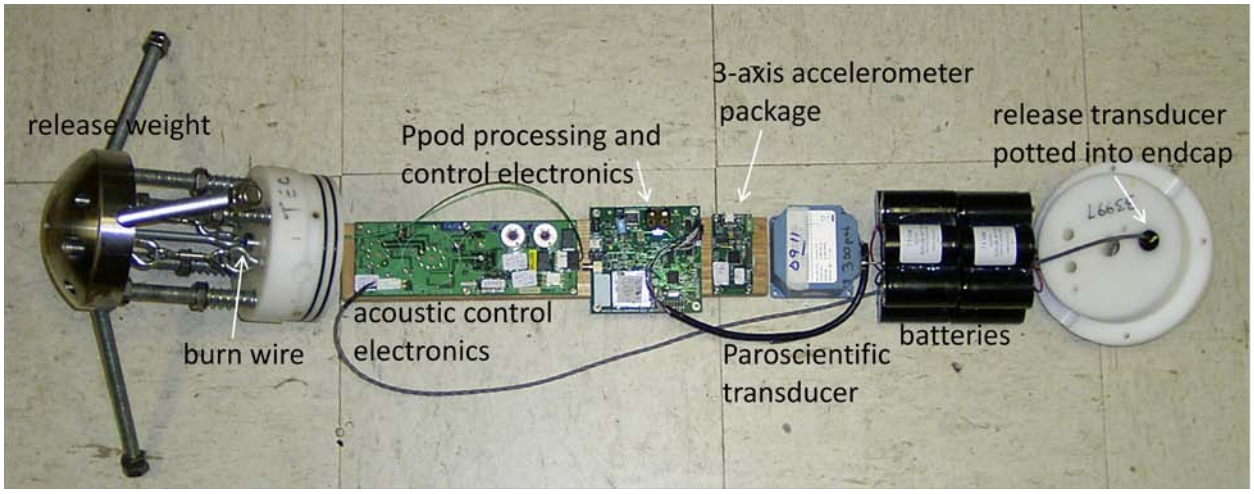

Figure 1 – Air Ppod as configured for helicopter launch tests. Three air launches survived surface impacts of 22-45 g's, followed by bottom impacts of about 3g's in 10 m of water.

Ppods were deployed in Massachusetts Bay as part of a separate project in September 2008 and July 2009 (Jim Lerczak and Kipp Shearman, both from OSU). Data have been shared with Lerczak and Shearman and used by us to test nonlinear internal wave detection algorithms and to begin to evaluate the three-dimensionality of nonlinear internal wave fronts.

RESULTS

A nonlinear internal wave antenna constructed of 14 seafloor pressure sensors was deployed in Massachusetts Bay in July 2009 as part of a larger experiment to look at the shoaling nature of the waves there (Lerczak/Shearman). Examples of the signature of a single wave at 8 locations in the array are shown in Figure 2. Vector wave speeds were computed at centroids of seafloor pressure sensor triads (Figure 3). These show the shape and evolution of wave groups as they progress westward into shallow water. They indicate a remarkably small cross-frontal expanse of the waves in this section of the Bay. The observed three-dimensionality is being compared to shipboard radar and satellite observations as well as model results of nonlinear internal waves from the region.

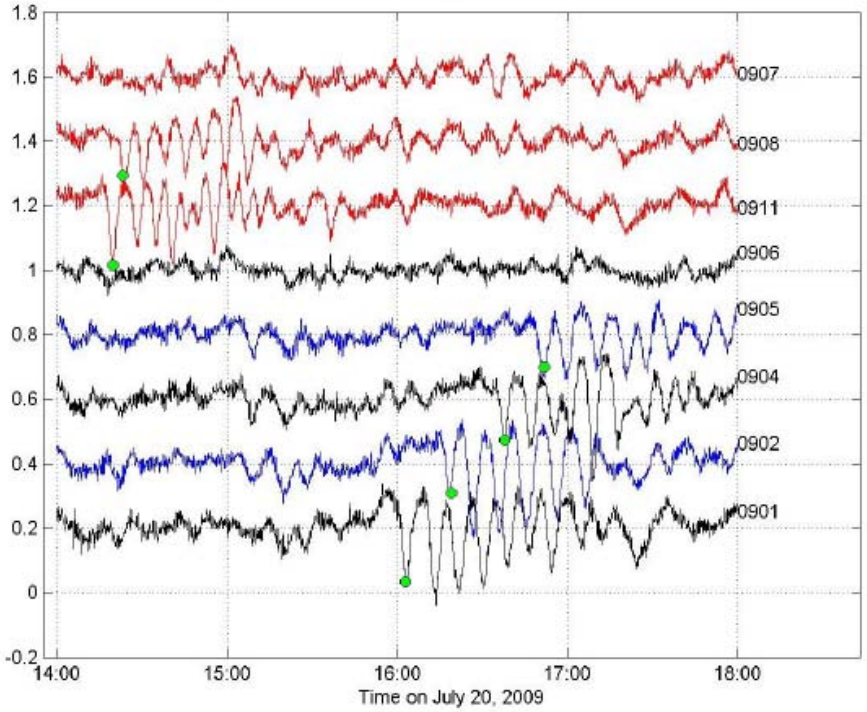

Figure 2 – Detection of nonlinear internal waves at various locations in the array depicted in Figure 3. The leading waves that are clearly detected are noted by the green dots. The finite extent of the wave fronts is indicated by the lack of signal at the northernmost locations (0906, 0907).

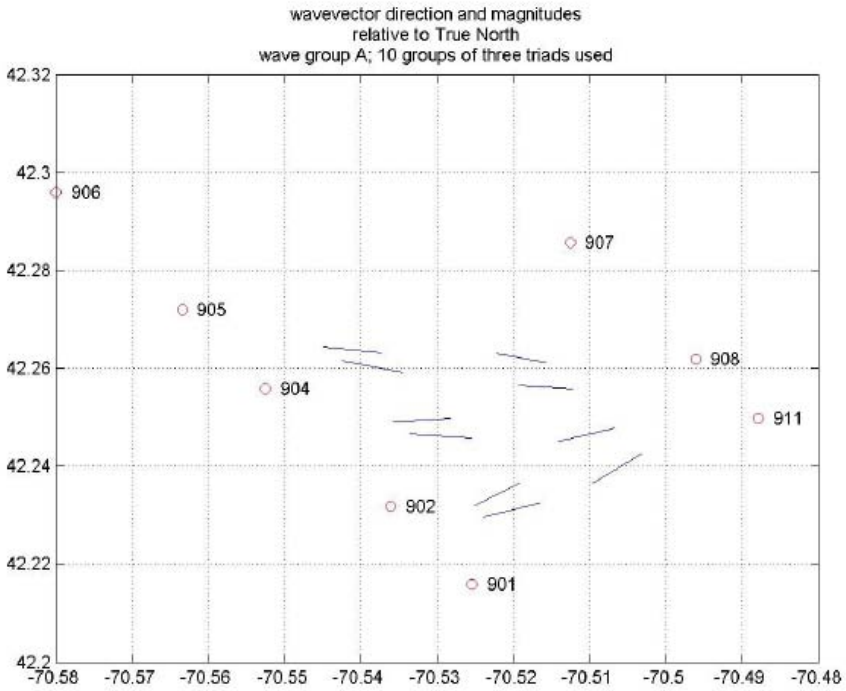

Figure 3 – Vector wave speeds of the leading nonlinear internal wave shown in Figure 2. These are shown at varying locations in the array corresponding to the centroids of seafloor pressure sensor triads.

IMPACT/APPLICATION

The objective of this project is to develop an easy-to-deploy and inexpensive means to outfit continental shelves with seafloor-based nonlinear internal wave antennae. A successful demonstration has been made this past summer in Massachusetts Bay. This will help in defining internal wave climates on continental shelves.

RELATED PROJECTS

Ppods have and are being used in related projects to help us gain experience with interpreting the measurement over a broad range of conditions. These have included measurements over Stonewall Bank (June 2008; Moum / Nash / MacCready / Skyllingstad), in Massachusetts Bay (July – October 2008, and July 2009; Lerczak / Shearman) and in Puget Sound (March 2009, December 2009 and March 2010).

REFERENCES

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